EARLY AIR CAR PATENTS

1884-1928

331,276. VELOCIPEDE. CHARLES E. BUELL, Springfield, Mass., assignor of one-third to Wilbur B. Cooley, Easton, Pa. Filed Oct. 16, 1884. (No model.)

Claim.—1. The combination, with a tricycle, of the holder B, provided with a valve, V, and removably attached to said tricycle, an engine mounted upon said tricycle and adapted to propel said tricycle, and means for connecting said holder B to supply said engine, substantially as described.

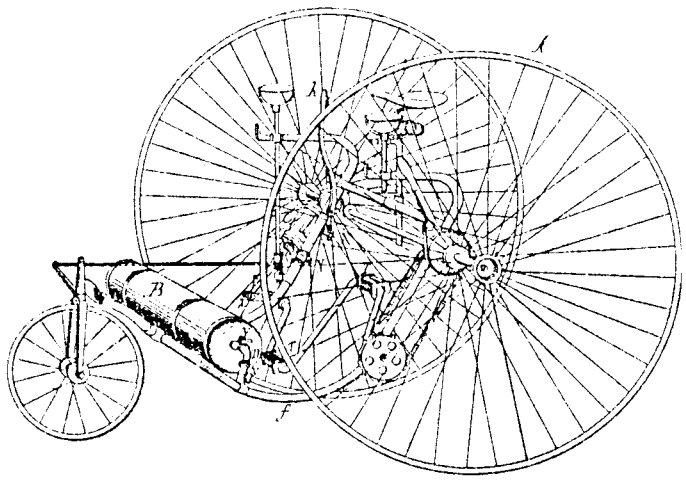
2. The combination, with a tricycle, of the holder B, removably attached thereto, an engine mounted on said tricycle, and means for connecting said holder B to supply said engine that are provided at two points with devices for controlling the flow of air from said holder B to said engine.

3. The combination, with a tricycle, of the removably-attached holder B, an engine for propelling said tricycle, and a throttle-valve provided with a lever for controlling the air-supply to said engine.

4. The combination, with a vehicle having a hollow frame charged with compressed air, of the holder B, removably attached to said vehicle and portable therewith, an engine mounted on said vehicle, and suitable means for connecting said holder B and said frame successively to said engine to supply it with air for propelling said vehicle.

5. The combination, with a vehicle having a hollow frame charged with compressed air, of the holder B, removably attached to said vehicle and portable therewith, an engine mounted on said vehicle, and suitable means for connecting said holder B and said frame successively to said engine to supply it with air for propelling said vehicle, and added means for controlling the flow of air to said engine.

6. The combination, with a vehicle, of the holder B, provided with a valve, V, removably attached to said vehicle, an engine mounted upon said vehicle and adapted to propel said vehicle, means for connecting said holder B to supply said engine, and independent devices for propelling said vehicle by foot-power, substantially as described.



J. I. PITTMAN & E. HARRISON.

AIR MOTOR OR LOCOMOTIVE.

APPLICATION FILED MAY 7, 1906.

931,648.

Patented Aug. 17, 1909.

3 SHEETS—SHEET 1.

Fig. 1.

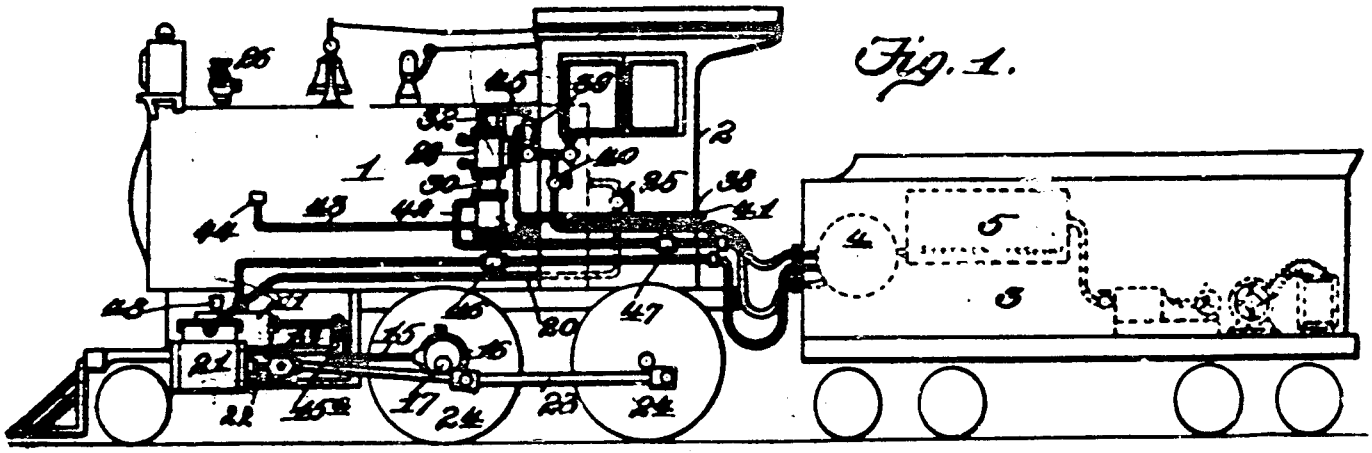
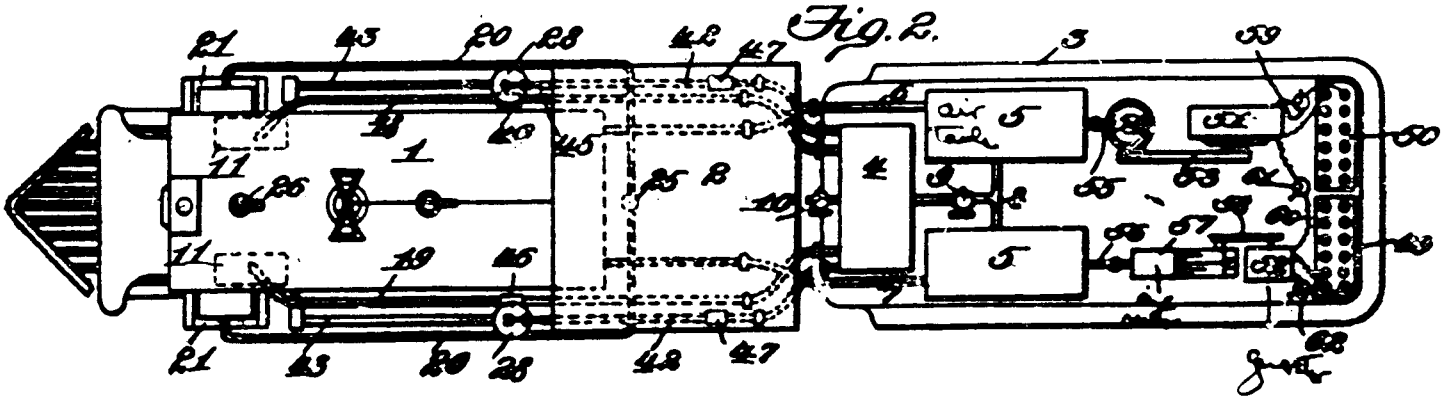


Fig. 2.



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J. I. PITTMAN & E. HARRISON.

AIR MOTOR OR LOCOMOTIVE.

APPLICATION FILED MAY 7, 1906.

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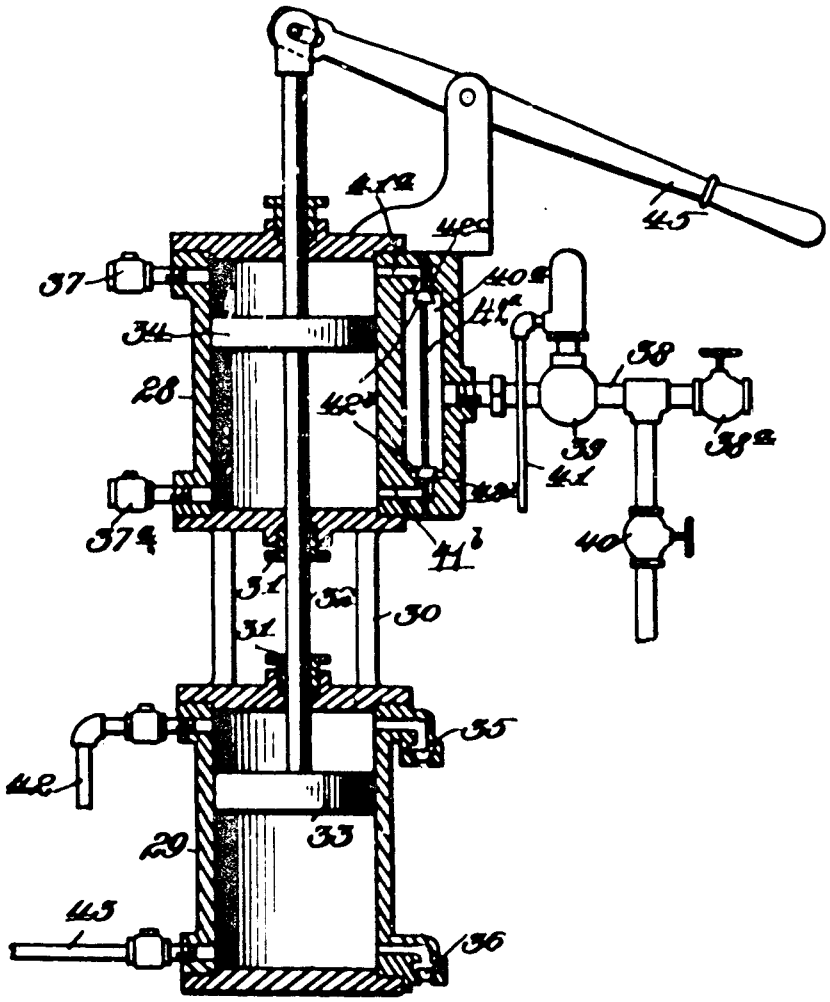
3 SHEETS—SHEET 3.

Fig. 3.



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UNITED STATES PATENT OFFICE.

JAMES IRA PITTMAN AND ELIZABETH HARRISON, OF VALDOSTA, GEORGIA; SAID HARRISON ASSIGNOR TO SAID PITTMAN.

AIR MOTOR OR LOCOMOTIVE.

No. 931,643. Specification of Letters Patent. Patented Aug. 17, 1909.

Application filed May 7, 1906. Serial No. 315,655.

To all whom it may concern:

Be it known that we, JAMES IRA PITTMAN and ELIZABETH HARRISON, citizens of the United States, residing at Valdosta, in the county of Lowndes and State of Georgia, have invented new and useful Improvements in Air Motors or Locomotives, of which the following is a specification.

This invention relates to air controlled motor devices such as locomotive and stationary engines, vehicles and other mechanical organizations which can be driven or operated by air under compression.

In the preferred application of the invention to locomotive engines, the latter are equipped with the usual wheel driving mechanism and cylinders with which the pumps coöperate, a portion of these pumps being actuated solely by the movable elements of the engine, and the remaining portion of the pumps being manually operative and used only to start the engine and connected to a receiving reservoir having communication by means of suitable pipes with storage reservoirs, and the storage reservoirs attached by conduits to a distributing reservoir simulating the usual boiler of a locomotive.

The course pursued in starting and stopping the engine or other motor device with which the invention is used will be more fully hereinafter specified, and in all applications of the invention the object sought is a material saving in the expense of running a locomotive or other motor, as no fuel is required loaded on and carried by the motor, and the mechanism ordinarily employed in connection with steam engines and other motors is reduced to a minimum in the present organization.

A further object is to maintain at all times within the distributing reservoir an effective air pressure for actuating the pistons, drive wheels, and other mechanisms.

In the drawings, Figure 1 is a side elevation of an air locomotive embodying the features of the invention. Fig. 2 is a top plan view of the locomotive. Fig. 3 is a detail transverse section, on an enlarged scale of one of the auxiliary pumping devices.

Similar numerals of reference are employed to indicate corresponding parts in the several views.

The numeral 1 designates a distributing reservoir simulating an ordinary locomotive boiler, but without the usual tubes and flues or other incidental attachments necessary in the control of steam production, conveyance, and storage. This reservoir will extend at its rear terminal into a suitable cab 2, and attached to the working organization of the engine is the usual form of tender 3, which, in this instance will serve not as a means for holding fuel, but as a support and convenient device for positioning a receiving reservoir 4 and storage reservoirs 5.

The storage reservoirs 5 are attached by pipes 6 and 7 to the distributing reservoir 1 and between the said storage reservoirs and the receiving reservoir 4 is a connecting T-pipe 8, having a valve 9 in one branch thereof. The receiving reservoir 4 also has a relief or exhaust valve 10, for a purpose which will be presently set forth. On opposite sides of the longitudinal center of the forward portion of the engine and under the forward portion of the distributing reservoir 1 are pumps 11, which have suitable pistons and piston rods 13 connected by link rods 15 and a rock shaft 15^a to eccentrics 16 on one of the engine axles 17. The eccentric mechanism 16 operates the pumps, and the latter are of any preferred air pump construction, and are connected by pipes 18 and 19 to the receiving reservoir 4.

The distributing reservoir 1 has opposite pipes 20 extending from the rear thereof downwardly to cylinders 21, the latter having suitable piston rods 22 coöperating therewith and attached to drive rods 23, for actuating drive wheels 24 of the engine, this latter construction being similar to an ordinary locomotive engine. The feed of the air from the distributing reservoir 1 to the cylinders 21 is controlled by a throttle valve 25 of suitable nature and accessible within the cab 2. The distributing reservoir 1 is also supplied with an inlet valve 26 located at the upper portion thereof for attachment thereto of a tube or suitable connection from an air compressing mechanism that may be at a station or other supply point for initially charging the said reservoir with air to give the engine sufficient power or motive force to set the pumps in action. The reservoir 1 will have a large capacity in practice and a large volume of compressed air may be stored therein, this reservoir serving as a main generating means between specified points or interval stations where it will be replenished or resupplied with compressed

air whenever found necessary. By the operation of parts hereinafter specified and particularly the pumps 11 some air will be forced back in the receiving reservoir 4 and from the latter flow into the storage reservoirs 5 which serve as feeders for the distributing reservoirs 1 when opened for communication with the said distributing reservoir. The pressure in the distributing reservoir 1, however, will always be materially greater or in excess of that required to operate the driving mechanism of the locomotive or engine and from time to time the said distributing reservoir will be replenished from the storage reservoirs 5 or at times when the quantity of compressed air in the distributing reservoir runs low and the engine is liable to stop before arriving at a station having a charging apparatus connectible with the said distributing reservoir.

In the operation of the motor, the compressed air is fed to the cylinders 21, which are entirely independent of the pumps 11 and have no connection with the latter, and through the operation of the pistons in the cylinders, which move alternately in opposite directions as in ordinary locomotive engines, the drive wheels 24 will be actuated.

In addition to the usual link motions and slide valves, the improved engine will include a signal device such as a whistle, if found necessary, or a bell operative from the cab, a head-light, and a fender or catcher.

After the engine is started, when less power is required to maintain the motion than was required to start it, the pumps will be thrown into service to compress air in the reservoirs 4 and 5, to be eventually supplied to reservoir 1, to compensate for the amount of air withdrawn in excess of present needs, but when a stop is made the valve 9 will be closed and the valve 10 opened to prevent the establishment of pressure between the receiving reservoir and the two storage reservoirs 5, and to liberate air from the reservoir 4, so that the latter may be clear for receiving air from the pumps 11, for instance after the engine is again started. In a case of emergency the hand pumps may be operated to charge the distributing reservoir through the receiving reservoir 4 and storage reservoirs 5, and when the hand pumps are operated the air that may be in the reservoir 4 at the time is liberated, so that the air may pass from the hand pumps into the reservoir 4 and from the latter into the reservoirs 5 and then into the distributing reservoir, the hand pumps being operated continuously until sufficient air has been compressed in the distributing reservoir to actuate the driving mechanism including the pumps 11. All the reservoirs will be of such resistance, structurally, as to adapt them to receive air under pressure considerably in excess of that required to operate the locomotive, and thus avoid any tendency to expand or injury to the operator due to explosion. All of the reservoirs will be provided with suitable gages by which the amount of pressure within the several reservoirs may be readily ascertained.

It will be understood that the operation of the cylinders 21 and of the pumps 11 is entirely independent, or, in other words, the cylinders 21 are not the pumps, but separate organizations are used to pump the air, and have their pistons operated by the adjacent drive wheels through the medium of the eccentrics 16, connecting rods 15, and rocker arms or links 15ª.

When the engine is stopped by shutting off the air from the cylinders through the operation of the throttle or controlling valve 25, the receiving reservoir 4 is cut out from the storage reservoirs 5 to obviate any tendency to equilibrium of pressure in the several reservoirs, and when the receiving reservoir is cut out, as set forth, the relief or exhaust valve 10 thereof is opened to permit all the air contained in the receiving reservoir to escape. If the air was allowed to remain in the receiving reservoir 4 when the engine is stopped and communication be maintained between said receiving reservoir and the storage reservoirs, the receiving reservoir would not be in condition for further receiving air from the pumps 11, or in the case of emergency by the operation of the hand pumps on opposite sides of the engine adjacent to the forepart of the cab, and for this reason equilibrium of pressure in the reservoirs 4 and 5 must be obviated to avoid blocking the movement of the engine in starting the latter, and which would result if there was a resisting amount of air in the reservoir 4 to the introduction of any more air in the said reservoir when the engine is started. In starting the engine, the throttle or controlling valve 25 is opened, the valve 10 closed, and at a proper interval after the engine is in motion communication between the receiving and storage reservoirs is reëstablished, the engine when in motion operating the pumps 11 to force air backwardly into the receiving reservoir 4 under compression. When the engine is stopped and ready to start again the receiving reservoir will have no pressure on it and the engine will move off quickly as there will be no resistance to such motion but the draft strain of the train.

The initial charging of the engine with air may be accomplished, in a simplified manner, by attaching the inlet valve 26 to an air pumping means located at a station or other supply point and during such initial charging of the distributing reservoir the valve 25 will be closed. The pressure of the air thus initially stored in the reservoir 1 will have sufficient power or motive force to set the pumps in action when the valve 25 is opened,

or to serve as a motive means until the engine is under headway and the air from the pumps 11 regularly forced back and compressed in the receiving reservoir 4, as before explained.

One of the most essential conditions precedent to the practical operation of the motor is the relative dimensions of the pumps 11 and cylinders 21 or the proportionate areas of the pistons of the pumps and cylinders. Care will be exercised in the construction of these pumps and cylinders from a standpoint of proportions or difference in areas to insure a replenishment of the compressed air within the distributing reservoir 1 through the actuation of the pumps in amount approximately equal to the amount of air fed from the said distributing reservoir to the cylinders or the exhaust of the compressed air from the distributing reservoir in excess of that required when the pumps are in service to maintain the motion of the motor and its load, the said pumps forcing the air backwardly into the auxiliary reservoir 4 and storage reservoirs 5 and from the latter into the distributing reservoir, as hereinbefore indicated. The motor pistons should have an area greater than that of the pump pistons by a difference sufficient to receive so much power from the distributing reservoir as is required to maintain the motion after it has been established under ordinary conditions. When the motor is getting under way the pumps are out of service or are working against a resistance not yet accumulated to its maximum. At this time the power applied in the motor cylinders is, to start with, a maximum due to the pressure in the distributing reservoir applied to the whole areas of the motor pistons. The net power applied is gradually reduced from this maximum to that due to the pressure in the distributing reservoir applied to the difference between the areas of the cylinder pistons and those of the pump pistons. In going up grade the pumps may be thrown out of service, if required, thus obtaining the maximum power again at this time. In going down grade, under conditions favorable to the action, the supply valve 25 may be closed, and the fall of the motor and its load may be utilized to operate the pumps to store compressed air, thus replenishing the supply of power. In cases of emergency or when it is found that the gages indicate a low pressure present in the several reservoirs, the hand pumps or the electrically operated pumps may be independently utilized for restoring the necessary pressure in the distributing reservoir.

The locomotive engine is also shown equipped with a hand or manually operated pump on each side which will be used independently of the air pumping devices located at stations or other points for initially charging the reservoir 1 or to otherwise replenish said reservoir if found necessary at any time during the operation of the engine. This auxiliary manually operative pump consists of an upper section 28 and a lower section 29, both sections being in the form of cylinders which are independent of each other and connected by an intermediate tubular union 30, provided with suitable stuffing boxes or glands 31, through which and the cylinders a piston rod 32 extends and has on its lower end a piston head 33 and on its upper portion a piston head 34. The lower cylinder 29 with the piston head 33 serves as a double acting pump and has upper and lower inlet valves 35 and 36. The upper cylinder and its piston 34 is also a double acting pump and has suitable inlet valves 37 and 37^a. Connected to an intermediate portion of the upper cylinder 28 is a pipe 38 having an exhaust valve 38^a and a suitable governor 39 and a controlling valve 40. This pipe 38 extends rearwardly and is connected to the reservoir 4. The pipe 38 connects with a valve chamber 40^a in a part of the wall of the section or cylinder 28, and said valve chamber has upper and lower passages 41^a and 41^b communicating with the upper and lower portions of the interior of said section or cylinder. Within this valve chamber is a slide stem 42^a, with valves 42^b fixed thereon and operating to alternately open and close against seats 42^c and 42^d. The upper part of the auxiliary pump, when the valve 40 is open, will be effective in storing air under pressure in the reservoir 4 during opposite strokes of the piston 34, but when the valve 40 is closed there will be no resistance to the operation of the lower piston 33 by reason of the escape of the air through the exhaust valve 38^a, the latter being opened under such conditions. The governor 39 may also have a train pipe 41 attached thereto and the upper part of this auxiliary pump under these conditions, or where the train pipe 41 is attached thereto, may be utilized in pumping air into the train line when the valve 40 is closed.

The lower piston 33 operates on both strokes, through the medium of the upper and lower inlet valves 35 and 36, to alternately draw in and force air outwardly under compression therefrom, a pipe 42 being connected to the upper part of the lower section or cylinder 29 and also to one end of the receiving reservoir 4. A second pipe 43 is connected to the lower portion of the section or cylinder 29 and to the main or distributing reservoir 1, said pipe having a suitable check-valve 44 therein to prevent the air stored in the reservoir 1 from passing back to the lower section or cylinder 29.

Through the medium of the pipe connec-

tions 42 and 43, both the distributing reservoir 1 and the receiving reservoir 4 will be supplied with air, and from the receiving reservoir, the air will pass to the storage or auxiliary reservoirs 5, and thus the locomotive will be initially prepared by the auxiliary pump set forth for starting operations and supplied with a pressure sufficient to overcome the tractive resistance of the locomotive and cars that may be attached thereto. The pistons 34 and 33 and the piston rod 32 are actuated by a hand lever 45, projecting rearwardly from the pump within easy reaching distance through the forward part of the cab.

In addition to the check valve 44, the other pipes between the pumps 11 and receiving reservoir 4 and between the manually operative pumps located immediately in advance of and close to the cab 2 will be provided with suitable check valves, as at 46 and 47 for preventing the air from passing down to the pumps when the pistons of the latter are moving backwardly to take thereinto new charges of air, and each of the pumps will have a distinct check valve 48 which will automatically open when the auxiliary reservoir 4 is cut out to permit the escape of the air from the pumps so that the latter may continue to operate until the filled reservoir 4 is relieved of a portion of the air compressed thereinto, or is free for storage of another charge of air therein by the said pumps, it being understood that the check valves 48 of the pumps will open only under excess pressure and not under normal conditions or when the receiving reservoir is thrown into communication with said pumps.

It will be understood that the pumps 11 will be constructed in all particulars similar to ordinary air pumps, and provided with suitable inlets and relief means, and in view of the use of the check valves 46 in the pipes 18 and 19 the air from the reservoir 4 cannot escape back to the pumps, and when liberated by the opening of the valve 10 will be forced to pass out through the said latter valve.

From the foregoing it will be seen that the locomotive is equipped with pumping means to meet various contingencies, and the same pumping mechanisms and reservoir devices may be equally well used in connection with other motors either of a stationary or movable type.

The proportions and dimensions of the several reservoirs may also be changed at will, as well as minor details of construction to adapt the improved locomotive or motor for various uses.

As a further effective auxiliary in the operation of the motor device hereinbefore explained, a storage battery comprising two battery sections 49 and 50 is disposed in the rear extremity of the tender of the motor or air locomotive and electrically connected. An electric motor 51 is connected to the battery section 50, and a generator 52 is electrically connected to the storage battery section 49. The motor 51 has a pitman bar or other analogous element 53 operatively attached thereto and also to an air pump 54, having communication with one of the storage reservoirs 5 through the medium of a valved pipe 55. A valved pipe 56 is connected to the remaining storage reservoir 5, and communicates with an air engine or motor 57, having a pitman bar or other analogous device 58 attached thereto and also to the generator 52. The generator 52, as before indicated, is electrically connected to the storage battery section 49. The function of the auxiliary apparatus just described is to start the air motor or locomotive without operating the hand pumps hereinbefore explained, and in the event that there is no air stored to start, the battery section 50 is connected to the electric motor 51, through the medium of a switch 59. The motor 51 is thus set in motion and the pitman bar 53 actuates the pump 54 to force air into the adjacent storage reservoir 5, it being understood that the valve in the pipe 55 will first be opened. This electrical auxiliary apparatus will always be ready for use or service, particularly if the hand pumps become disordered and it becomes necessary to recharge the distributing reservoir before a main charging station is reached or in case the pressure in the distributing reservoir runs so low as to be ineffective in propelling the locomotive.

Having thus described the invention, what is claimed, is:

1. In an air motor of the class described, a distributing reservoir adapted to be charged at intervals from air compressing stations, storage reservoirs connected to the distributing reservoir, a receiving reservoir having pipe connection with the storage reservoirs, the pipe connection being provided with cut-off and exhaust valves, driving mechanism including cylinders and pumps, tubular supply connections between the cylinders and distributing reservoir, tubular connections between the pumps and receiving and storage reservoirs, and hand pumps for charging the distributing reservoir in the event that the pressure in the latter runs low.

2. In an air motor of the class described, a distributing reservoir adapted to be charged at intervals from air compressing stations, storage reservoirs connected to the distributing reservoir, a receiving reservoir having pipe connection with the storage reservoirs, the pipe connection being provided with cut-off and exhaust valves, driving mechanism including cylinders and pumps, tubular supply connections between the cyl-

inders and distributing reservoir, tubular connections between the pumps and receiving and storage reservoirs, and auxiliary electric motor means and pump devices connected to the storage reservoirs.

3. In an air motor of the class described, a distributing reservoir and means for charging and maintaining the necessary quantity of air under pressure in the distributing reservoir and including pump means actuated by the motor while traveling, and other pump means operable independently of the first named pump means, all the pump means being connected up to the distributing reservoir and that actuated by the traveling movement of the motor having a controllable exhaust coöperating therewith and which will permit the latter pump means to run without storage effect.

4. In a motor driven solely by compressed air, a distributing reservoir, means for charging and maintaining the necessary quantity of air under pressure in the distributing reservoir and including pump means actuated by the motor while traveling, cylinder means supplied with compressed air from the distributing reservoir and serving as the main driving means for the motor, and valve means controlling the relative supply and exhaust of the air.

5. In a motor driven solely by compressed air, a distributing reservoir, means for charging and maintaining the necessary quantity of air under pressure in the distributing reservoir and including pump means actuated by the motor while traveling, and driving mechanism for the motor including drive wheels and cylinder means, the cylinder means being supplied with air under pressure from the distributing reservoir to actuate the drive wheels, the pump means serving solely to establish air pressure within the reservoir.

In testimony whereof we have hereunto set our hands in presence of two subscribing witnesses.

JAMES IRA PITTMAN.
ELIZABETH HARRISON.

Witnesses:
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No. 865,496. PATENTED SEPT. 10, 1907.

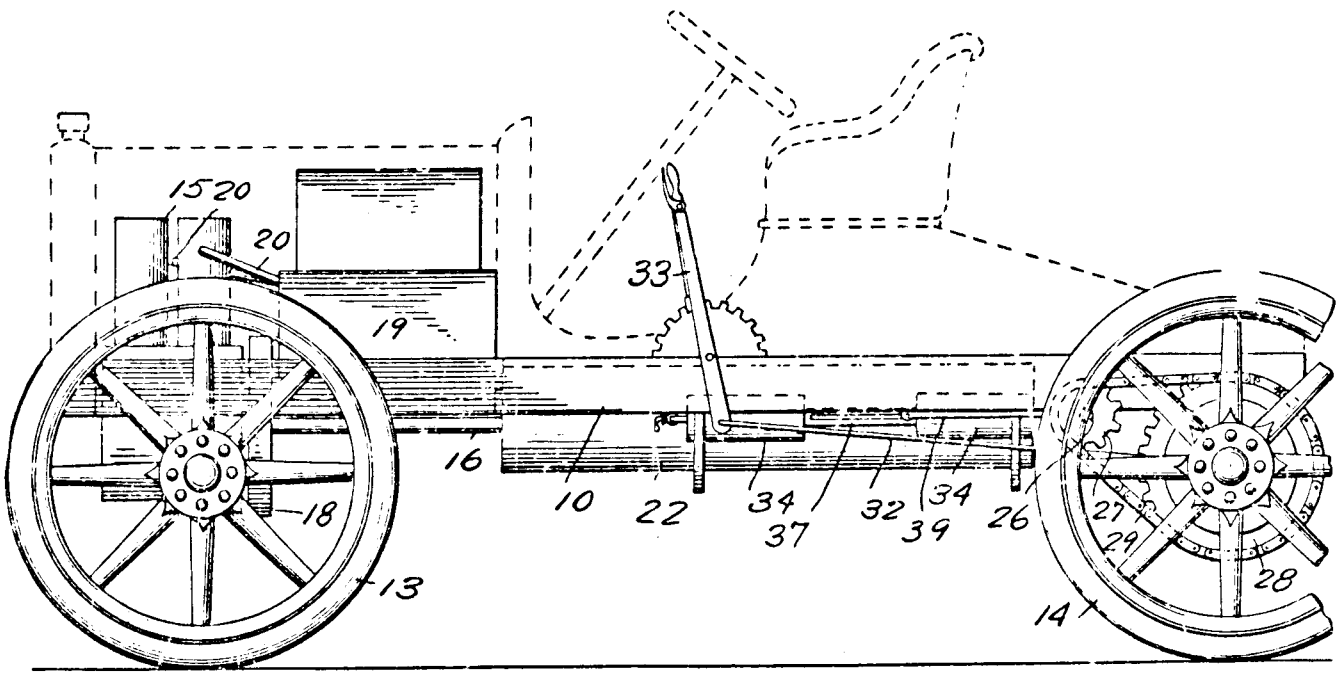
F. G. HERRINGTON.

COMPRESSED AIR MOTOR FOR AUTOMOBILES.

APPLICATION FILED MAY 25, 1907.

3 SHEETS—SHEET 1.

Fig. 1.



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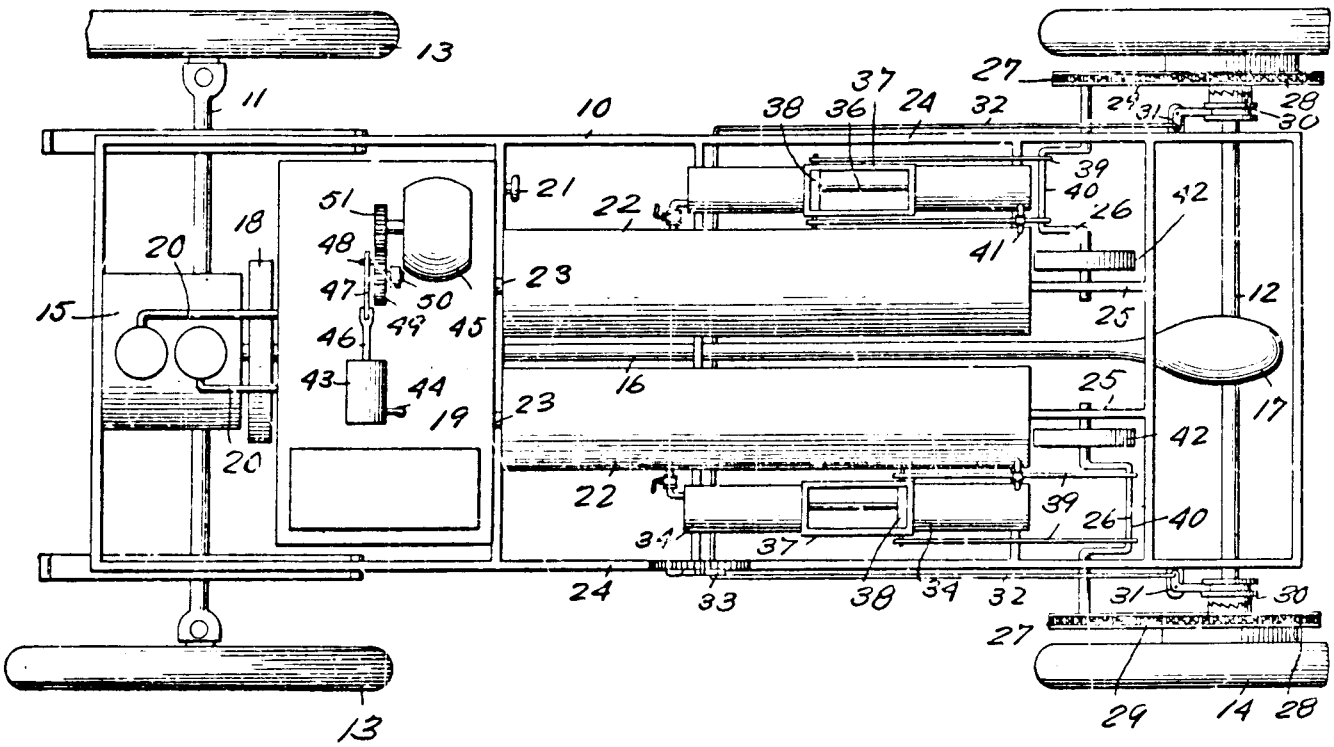
3 SHEETS—SHEET 2.

Fig. 2.



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3 SHEETS—SHEET 3.

Fig. 4.

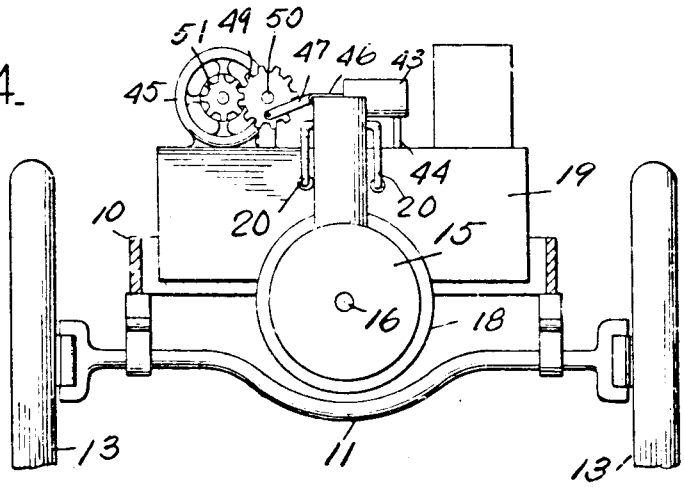
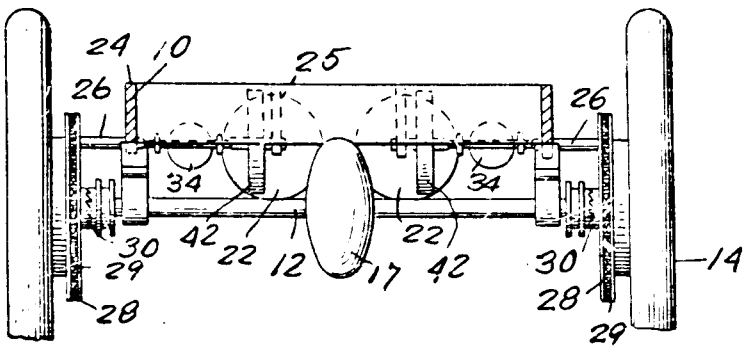


Fig. 5.



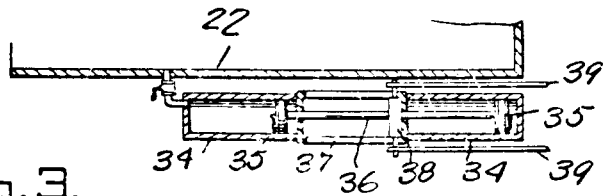


Fig. 3.

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FRED G. HERRINGTON, OF DECATUR, ILLINOIS.

COMPRESSED-AIR MOTOR FOR AUTOMOBILES.

No. 865,496. Specification of Letters Patent. Patented Sept. 10, 1907.

Application filed May 25, 1907. Serial No. 375,692.

To all whom it may concern:

Be it known that I, FRED G. HERRINGTON, a citizen of the United States, residing at Decatur, in the county of Macon and State of Illinois, have invented certain new and useful Improvements in Compressed-Air Motors for Automobiles; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to motors and more particularly to that class which are designed primarily for use upon automobiles.

It is a well known fact that in the present forms of automobile motors, whether they be electric, steam, or explosive, the motor is required to do constant work practically the entire time that the automobile is running. There are many disadvantages to be found in the present forms of motive power employed in this connection and while owners of automobiles have become reconciled to these disadvantages they nevertheless exist. I have found that compressed air may be used as a motive power with great efficiency upon automobiles and that in fact, by the arrangement of air compressors and other elements embodied in my invention, the machine itself may be made to supply a portion of its own motive power.

More specifically my invention contemplates the employment of air compressors which are adapted for operation from the rear axle of the machine when the same is traveling down a steep grade or under other conditions which will be apparent from the description of the invention which is to follow. It is of course entirely impractical to generate sufficient motive power by this means alone, to run the machine at all times, and I therefore provide in addition to the compressors which are operated from the rear axle, other compressors which are operated by an electric motor, the motor being used of course to generate motive power for the upgrade travel of the machine or for travel under other conditions.

It will thus be seen that while the invention does not contemplate the generation of motive power entirely by the machine itself, I have greatly reduced, by the arrangement of compressors and other elements the cost of running an automobile as far as regards the motive power therefor.

In the accompanying drawings, Figure 1 is a side elevation of an automobile employing compressed air as a motive agent and using the compressors and other elements embodied in my invention, the body of the automobile being shown in dotted lines, Fig. 2 is a top plan view of the automobile showing the relation and construction of the compressors, motors, etc., the body of the automobile being however omitted, Fig. 3 is a detail horizontal sectional view through one of the compressors operated from the rear axle of the automobile and the tank into which compressed air is forced, Fig. 4 is a front end elevation of the automobile, parts being broken away to show the invention, and, Fig. 5 is a similar view but of the rear end of the automobile.

Referring more specifically to the drawings the bed frame of the automobile is shown as being of the usual construction and is indicated in general by the numeral 10. The front axle of the automobile is indicated by the numeral 11 and the rear axle by the numeral 12, the former being provided with wheels 13 the latter with wheels 14. A compressed air motor 15 is mounted at the forward end of the machine and the power shaft of the motor which is indicated by the numeral 16 extends rearwardly and is geared with the rear axle 12, the gearing not being shown but being inclosed in the usual gear casing 17. The usual fly wheel 18 is fixedly mounted upon the shaft 16 adjacent the motor 15 and the motor is supplied with air from a storage tank 19. This tank 19 is also located at the forward end of the machine and is supported upon the frame 10 in any suitable manner. The supply pipes leading from this tank to the motor are indicated by the numeral 20 and the tank is provided with a safety valve 21.

Before describing the compressors for furnishing the tank 19 with a supply of compressed air, it will be necessary to first describe other storage tanks into which the air is first compressed and which have communication with the main storage tank 19. These other storage tanks are indicated by the numeral 22 and are positioned parallel to each other and one upon each side of the compressed-air motor shaft 16, it being understood of course that the tanks extend longitudinally to the bed frame of the automobile and are supported thereon. The forward ends of the tanks are located adjacent the rear wall of the main storage tank 19 and communication is had between the tanks 22 and the tank 19 by means of pipes 23. Journaled in side and intermediate beams 24 and 25 which form a portion of the bed frame 10 of the automobile are crank shafts 26 it being understood that there are two such shafts, one being located at each side of the machine and rearwardly of the rear ends of the tanks 22. Each of these shafts 26 carries at its outer end a fixed sprocket gear 27 upon which and a similar gear 28 carried by the corresponding wheel 14 is engaged a sprocket chain 29, there being clutches 30 for the purpose of clutching the sprockets 28 with their respective wheels 14 under conditions which will presently be described. The clutches 30 may be operated in any suitable manner and I have shown a conventional form of operating means for each sprocket gear 28 and its wheel 14 an angle lever 31 having one of its arms of yoke formation and in engagement with a grooved collar formed integral with the gear. To the other end of the angle lever is connected the rear end of a connecting rod 32 and the connecting rods for

the two clutch operating devices extend forwardly and are adapted for simultaneous operation by a lever 33 at the front end of the machine.

Positioned directly outwardly of each of the tanks 22 and extending beside the same and in parallel relation thereto is a pair of air compressor cylinders 34 in each of which air compressor cylinders is arranged a piston 35, the pistons for the two cylinders being connected by a single integral piston rod 36 which in addition to working through the ends of the cylinders, works also through the ends of a cross head guide 37 which extends between the opposing ends of the cylinders 34 at each side of the machine. A cross head 38 works in each of the guides 37 and pivoted to the ends of the cross head are connecting rods 39 which are connected in a similar manner with the crank 40 of the corresponding crank shaft 26. These crank shafts are illustrated in the drawings as having their crank portions extending in opposite directions as is usually the case where coöperating crank shafts have a similar relation. Each of the air compressor cylinders 34 communicates by way of a valved pipe 41 with the adjacent tank 22 and it will be understood that when the sprockets 28 are clutched with the rear wheel 14 of the automobile, power will be transmitted to the crank shafts and to the pistons for the air compressors thereby resulting in air being compressed into the tanks 22 and subsequently into the tank 19 from which it may be admitted to the compressed air engine to operate the same. Fly wheels 42 are fixed upon the crank shafts 26.

As has heretofore been stated, it is not contemplated that the power required to compress the air is to be derived solely from the rear axle as this would be impractical and in order that air may be otherwise compressed, I have mounted at the forward end of the frame 10 an air compressor 43 which also has communication with the tank 19 by way of a tank 44 this compressor being driven from an electric motor 45. The compressor includes of course a piston 46 and connected with this piston is a pitman 47 which leads from a crank pin 48 on a cross head 49, the gear being mounted upon a shaft 50 which is counter to the shaft of the electric motor 45 and being in mesh with a pinion 51 upon the said motor shaft.

From the foregoing description of my invention it will be observed that the electric motor may first be utilized in the compression of air into the tank 19 and that the compressed air motor is operated by air supplied from this tank. When however the machine is traveling down grade, the electric motor 45 may be shut off and the sprockets 28 clutched with their respective wheels 14. The air compressors 34 will then be operated to produce the same result as the compressor 43 and as a matter of fact if the grade is steep or lengthy, sufficient air will in all likelihood be compressed to run the air compressed motor for considerable time without the necessity of bringing the electric motor 45 into use, it being understood that this not only saves frequent recharging of the batteries for the motor, but that considerable expense is spared in this and other respects.

What is claimed is—

1. A motive power for vehicles comprising a drive axle, a compressed air motor, gear connections between the power shaft of the motor and the drive axle, a main compressed air storage tank, a pipe establishing communication between the tank and the motor whereby the latter may be operated, sub-storage tanks in communication with the main storage tank, air compressors arranged to discharge into the sub-storage tanks, gearing between the said compressors and the drive axle whereby the former may be operated, a compressor arranged to discharge into the main storage tank, and a motor for operating said compressor, said motor being independent of the drive mechanism for the drive axle.

2. A motive power for vehicles comprising a drive axle, a compressed air motor, gear connections between the power shaft of the motor and the drive axle, a main compressed air storage tank, a pipe establishing communication between the tank and the motor whereby the latter may be operated, sub-storage tanks in communication with the main storage tank, air compressors arranged to discharge into the sub-storage tanks, crank shafts, connections between the crank shafts and the compressor pistons, a sprocket carried by each of the crank shafts, a sprocket loosely carried upon the drive axle adjacent each end thereof, sprocket chains connecting the sprockets at each side of the vehicle, a clutch for clutching each of the last mentioned sprocket gears with the drive axle, means whereby the said sprocket gears may be shifted upon the axle to render such clutch effective, an air compressor arranged to discharge into the main storage tank, and an electric motor for operating the compressor.

In testimony whereof, I affix my signature, in presence of two witnesses.

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S. S. VERNON.
COMPRESSED AIR POWER PLANT.
APPLICATION FILED MAY 5, 1917.

1,251,849.

Patented Jan. 1, 1918.
4 SHEETS—SHEET 1.

Fig. 1.

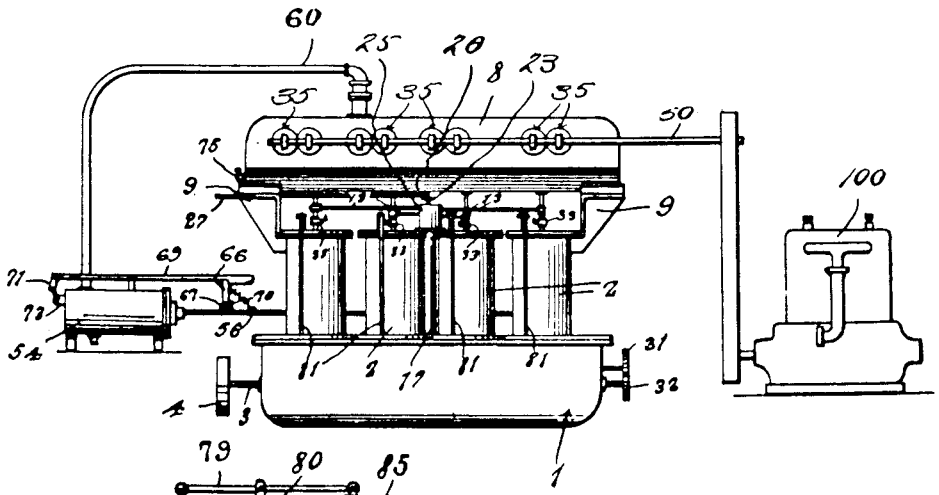


Fig. 3.

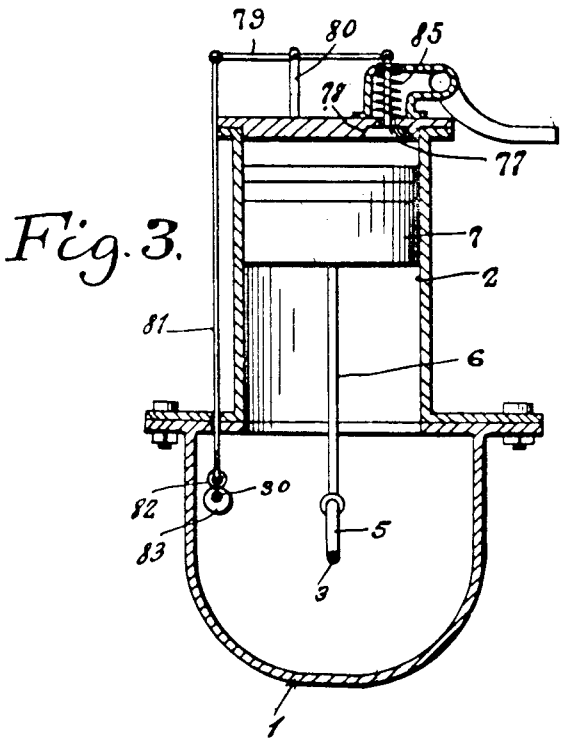
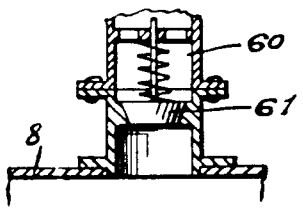


Fig. 10.



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4 SHEETS—SHEET 2.

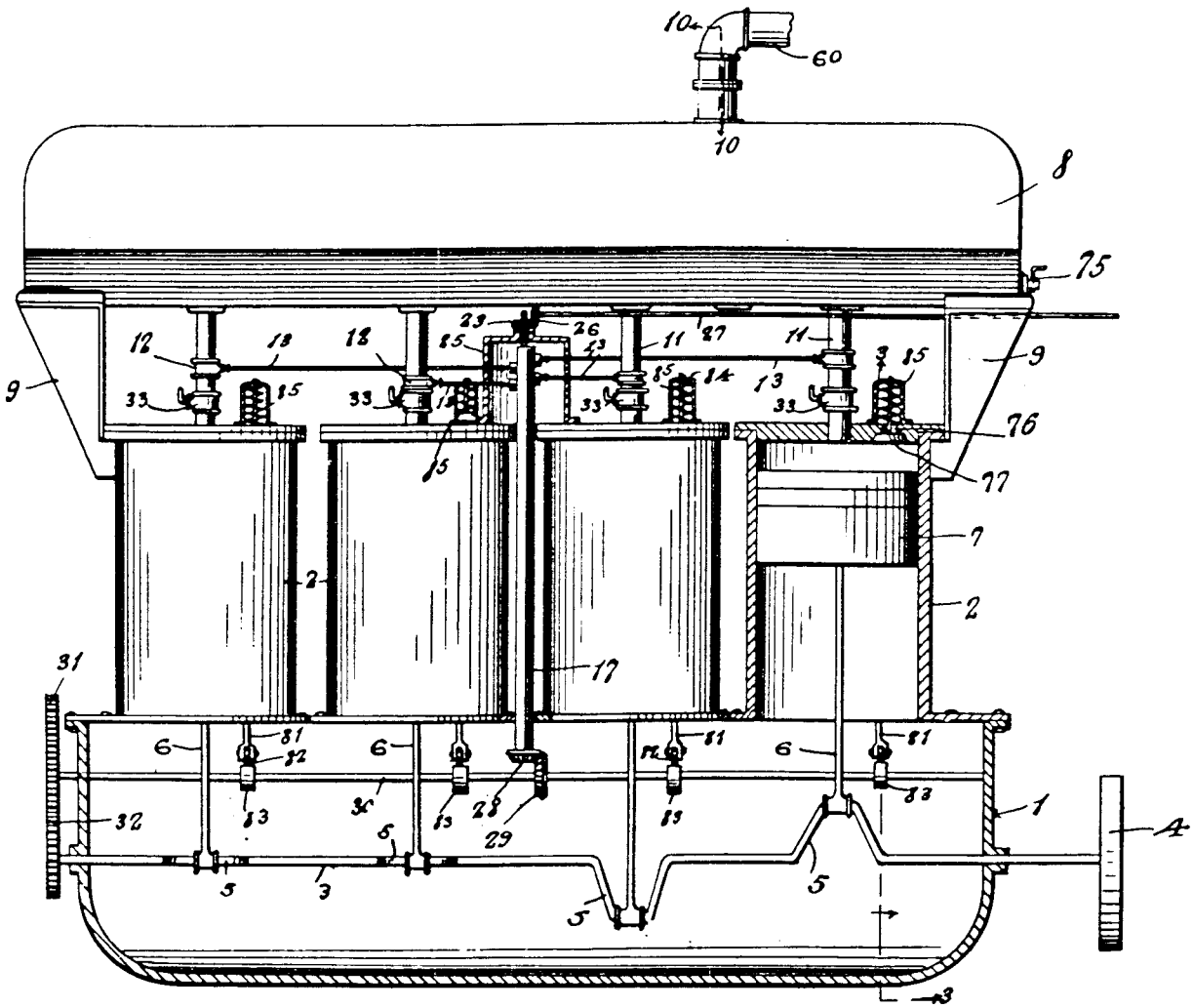

Fig. 2.

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4 SHEETS—SHEET 3.

Fig. 6.

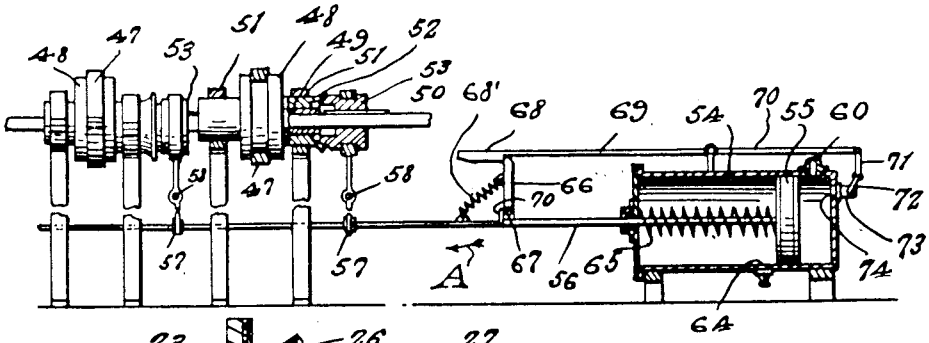


Fig. 4.

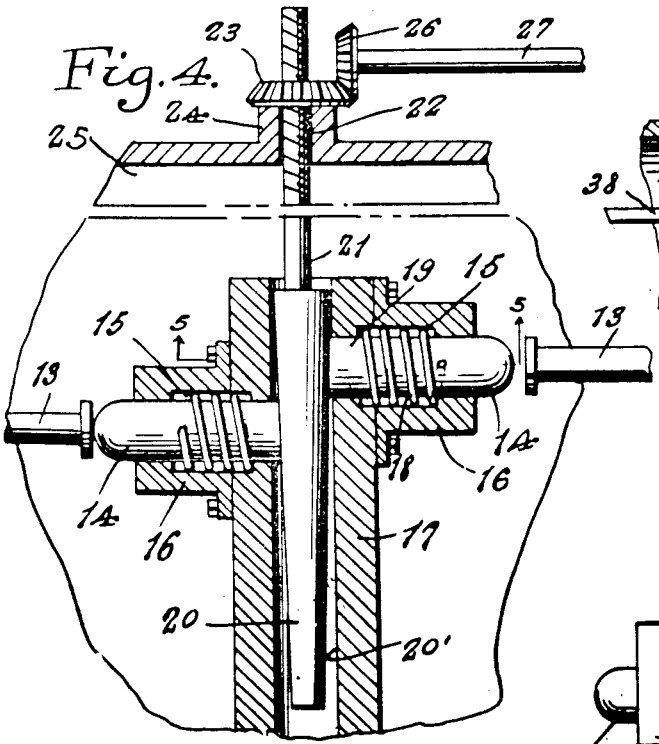


Fig. 9.

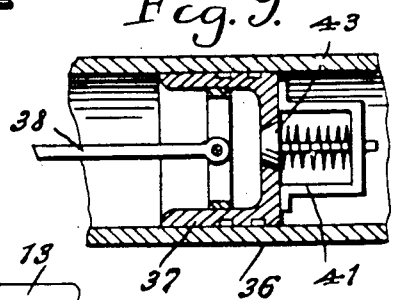
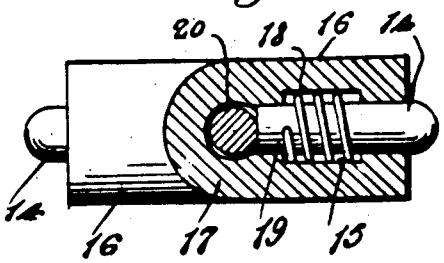


Fig. 5.



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1,251,849.

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4 SHEETS—SHEET 4.

Fig. 7.

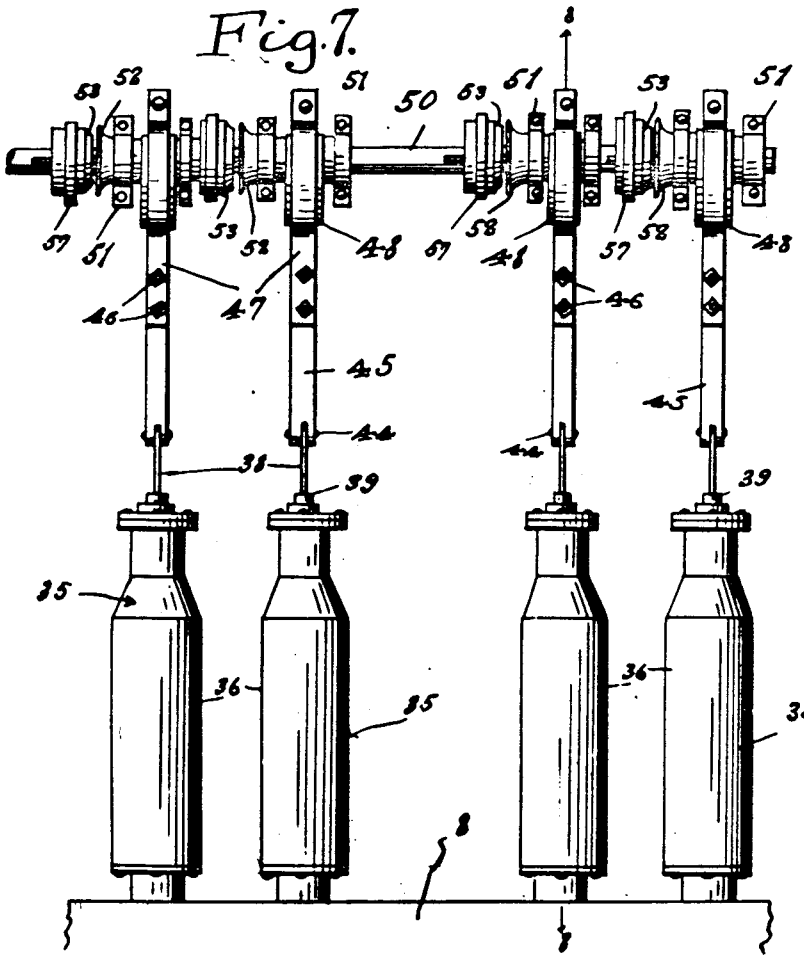
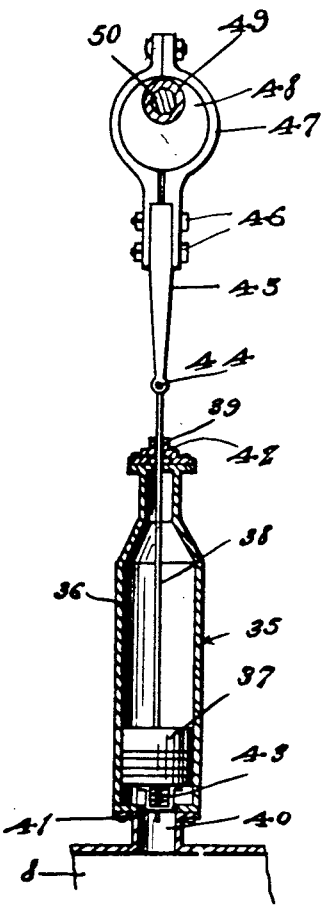


Fig. 8.



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UNITED STATES PATENT OFFICE.

SEWARD S. VERNON, OF PATERSON, NEW JERSEY.

COMPRESSED-AIR-POWER PLANT.

1,251,849. Specification of Letters Patent. Patented Jan. 1, 1918.

Application filed May 5, 1917. Serial No. 166,681.

To all whom it may concern:

Be it known that I, SEWARD S. VERNON, a citizen of the United States, residing at Paterson, in the county of Passaic and State of New Jersey, have invented certain new and useful Improvements in Compressed-Air-Power Plants; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to compressed air power plants and the primary object of the invention is to provide a power plant including an engine having a plurality of reciprocatory pistons which are operated by the forcing of compressed air within the cylinders which surround the pistons, which air is forced from a motive fluid chamber or reservoir into the top of the cylinder, upon the commencement of the down stroke of the pistons and further to provide means whereby the air that has been utilized by the engine will be exhausted out of the cylinders upon the up stroke of the pistons.

Another object of this invention is to provide a novel inlet valve controlling mechanism which is adjusted by the vertical movement of a conical member which engages and regulates the positions of valve stem striking members and the quantity of air admitted to each of the cylinders may be regulated as desired by the adjustment of the conical member.

A further object of this invention is to provide a plurality of air compressors which are operatively connected to the motive fluid reservoir of the engine and supply the necessary compressed air thereto for operating the engine.

A still further object of this invention is to provide means operable under an excessive air pressure within the reservoir for automatically arresting the operation of the air compressors until the air pressure within the reservoir falls to normal at which time the operation of the compressors is again started.

With the foregoing and other objects in view, this invention consists in such novel features of construction, combination and arrangement of parts as will be hereinafter more fully described, illustrated in the accompanying drawings and claimed.

In describing the invention in detail reference will be had to the accompanying drawings wherein like characters designate like and corresponding parts throughout the several views, and in which:

Figure 1 is a side elevation of the engine or motor showing the connection with the means for automatically controlling the operation of the air compressor, and also showing the air compressors or pumps and the prime mover employed for operating them, diagrammatically.

Fig. 2 is an enlarged view of the engine or motor showing the parts thereof in section,

Fig. 3 is a section on the line 3—3 of Fig. 2,

Fig. 4 is an enlarged section illustrating the conical members for adjusting the inlet valve operating members,

Fig. 5 is a horizontal section on the line 5—5 of Fig. 4,

Fig. 6 is a section through the means for automatically controlling the operation of the air compressor and showing its connection to the air compressor operating shaft and members,

Fig. 7 is a plan view of a series of air compressors,

Fig. 8 is a section on the line 8—8 of Fig. 7,

Fig. 9 is an enlarged section through one end of an air compressor cylinder, and

Fig. 10 is a section on the line 10—10 of Fig. 2.

Referring more particularly to the drawings, 1 designates the crank casing of the motor or engine upon which a plurality of cylinders 2 are mounted and through which extends the crank shaft 3 of the motor. The usual type of fly wheel 4 is mounted upon one end of the crank shaft 3 and the shaft is provided with a plurality of crank portions 5 each of which is disposed at a quarter circle or an angle of ninety degrees with respect to the one next thereto. The cranks 5 have the piston rods 6 connected to the wrists thereof as is usual in motor construction. The piston rods 6 and the pistons 7 carried thereby reciprocate within the cylinders 2. The supporting structure of the motor has a motive fluid reservoir or chamber 8 attached thereto in any suitable manner such as by the angle bracket 9 as clearly shown in Fig. 2 of the drawings. The reservoir 8 may be formed integrally with the cylinders, if desired, without departing from the spirit of this invention. The reservoir 8 is provided for retaining

the supply of compressed air which is employed for operating the engine. The reservoir 8 has a plurality of inlet openings 10 formed therein through which the air enters the cap from the air compressors, which will be hereinafter more fully described. The air egresses from the reservoir 8 through the pipes or tubes 11 which have communication with the interior of the cylinders 2 through the top of the cylinders so that the air entering the cylinders will strike the top of the pistons 7 and force the pistons downwardly.

The various pipes 11 have valves 12 positioned therein for controlling the passage of air from the reservoir 8 into the cylinders. The valves 12 have valve stems 13 connected thereto which valve stems are operated by members 14 for operating the valve.

The valve stem striking members 14 are slidably mounted in bores 15 which are formed in bosses 16. The bosses 16 are formed upon the upper end of a sleeve 17. Coil springs 18 are positioned within the bores 15 and have their innermost ends connected to the members 14 and their outer ends engaging the shoulder formed by the outer ends of the bores 15 for moving the members 14 inwardly. The inner ends of the members 14 engage the outer surface of a substantially frusto-conical adjusting member 20 which is mounted for vertical movement within the bore 20 and the adjustment of the substantially frusto-conical member 20 regulates the distance of the projection of the members 14 out of the bosses 16 and consequently regulate the stroke of the valve rods 13 and the distance of movement of the valve which in turn regulates the quantity of compressed air supplied to the interior of the cylinders 2.

The substantially frusto-conical member 20 has a vertical feed screw 21 attached to the upper surface thereof and projecting outwardly therefrom. The feed screw 21 extends upwardly through the feed nut 22 which has a beveled gear 23 attached thereto, the feed nut 22 being rotatably supported by a suitable collar 24 which is formed upon the top of the casing 25. The casing 25 incloses the valve stem operating members 14, as clearly shown in Fig. 2 and is attached in any suitable manner to a pair of the cylinders 2. The beveled gear 23 is rotated by a beveled gear 26 which is mounted upon a throttle rod 27. The throttle rod 27 extends outwardly beyond the motor or engine casing and is adapted to be manually operated for controlling the engine or motor.

The sleeve 17 has a beveled gear 28 mounted upon its lower end which rotates the sleeve for rotating the members 14 and moving them into engagement with the valve stem 13. The beveled gear 28 meshes with a second beveled gear 29 which is mounted upon a shaft 30. The shaft 30 is positioned within the crank casing 1 and rotatably supported by suitable bearings therein and it is operatively connected to the crank shaft through the medium of gears 31 and 32 which gears are arranged for properly timing the rotation of the shaft 30 and the operation of the valves.

The manually operated valves 33 are mounted in the pipe 11 so that in case the valves 12 fail to properly work, the supply of air to the cylinders may be cut off by the operation of the valves 33.

The compressed air necessary for the operation of the engine is supplied by air compressors 35, of the reciprocatory type which compressors include cylinders 36, in which are mounted reciprocatory pistons 37. The pistons 37 have piston rods 38 connected thereto which extend through stuffing boxes 39 carried at the inlet ends of the cylinders 36.

The outlet ends of the cylinders 36 have communication through a passageway 40 with the interior of the reservoir 8 or into any suitable receptacle as desired. The air is forced out of the cylinder 36 through the outlet opening 41 and is drawn into the cylinder behind the pistons upon the in or air compressing stroke of the piston through the air inlet 42. When the piston 47 starts upon its rearward stroke a spring controlled check valve 43, which is carried by the piston opens and allows the air to pass through the piston into the cylinder in front of the piston. The piston rod 38 is pivotally connected as shown at 34 to a pitman 45. The pitman 45 is connected, through the medium of bolts or the like 46 to an eccentric strap 47 which is mounted about an eccentric 48. The eccentric 48 is carried by a sleeve 49 which is rotatably mounted upon a shaft 50. The sleeve 49 is supported by suitable bearings 51 and it has a clutch section 52 carried by one end of the same which is adapted for coaction with a clutch section 53. The clutch section 53 is feathered or splined upon the shaft 50 so that when it is moved into engagement with the clutch section 52 the sleeve 49 and the eccentric 48 will be rotated by the rotation of the shaft 50, for controlling the operation of the air compressor. A mechanism identical with that heretofore described is applied for controlling the operation of all of the air compressors employed comprising the reservoir 8.

A structure is provided for automatically controlling the operation of the air compressor for arresting the air compressing operation of the members when the reservoir 8 becomes overcharged. This mechanism includes a cylinder 54 in which is mounted a reciprocable piston 55 to which a piston rod 56 is connected. The piston rod 56 has

arms 57 connected thereto at spaced intervals which arms are pivotally supported as shown at 58 and are connected to the clutch members 53 so that when the rod 56 is moved outwardly the rods 57 will be rocked for moving the clutch sections 53 out of engagement with the clutch sections 52.

The cylinder 54 has communication, through a pipe 60 with the cap 8. A pressure valve 61 is interposed in the pipe 60 so that when the pressure within the reservoir 8 exceeds the maximum pressure desired therefor, it will operate the pressure valve 61, and allow air to pass through the pipe 60 and enter the cylinder 54 in front of the piston, 55, thereby forcing the piston toward the rear end of the cylinder and operating the piston rod 56 in the direction indicated by the arrow A in Fig. 6 of the drawings, which will rock the rods 57 and disengage the clutch sections, thereby arresting the operation of the air compressors which will allow the lowering of the air pressure within the reservoir 8 through the utilization of the compressed air charge therein. The air is bled from the cylinder 54, during the rearward movement of the piston 55 by a bleed valve 64 which bleed valve will diminish the air pressure within the cylinder 54 and allow the spring 65 to act for returning the piston 55 to its normal position. An upstanding arm 66 is pivotally connected as shown at 67 to the piston rod 56 and it has a coil spring 68 connected thereto. During the outward stroke of the piston 55, the arm 66 will move downwardly and pass beneath the enlargement 68 formed upon the end of the rod 69; after the arms have passed the enlargement, the spring 68' will move the arm 66 to a vertical position and it is held against downward pivotal movement outwardly away from the cylinder 54 by a boss 70 so that when it strikes the enlargement 68 upon the return stroke of the piston, it will rock the rod 69 which will in turn rock the rods 71 and 72 sufficiently for moving the valve members 73, over the opening 74 formed in the cylinder 54 which will allow the complete exhaust of the air from the cylinder 54 and also allow the piston 55 to assume its normal position at which time the clutch sections 53 will be moved into engagement with the clutch sections 52 and the operation of the air compressors will be again started for charging the reservoir 8 with compressed air.

A drain valve 75 is carried by the reservoir and when it is desired to drain all of the air from the reservoir, it may be accomplished through the medium of this valve.

The cylinders 2 have their exhaust ports 76 positioned in the cylinder heads or tops and these exhaust openings are closed by the valve members 77. The valve members 77 are shaped so that air pressure within the cylinder will seat the valve to prevent the exhaust of air from the cylinders during the downstroke of the pistons 7. The valves 77 are carried by rods 78 which extend upwardly through the top of the cylinders and have their upper ends connected to pivotally mounted rods 79. The rods 79 are pivotally supported by suitable supports 80 and have rods 81 connected thereto. The rods 81 have rollers 82 mounted upon their lower ends which ride over the periphery of cams 83. The cams 83 are mounted upon the shaft so that during the upstroke of the piston 7 the rods 81 will be forced upwardly, for depressing the enlarged end 84 of the pivoted rods 79 for unseating the valve 77 to allow the escape of the air from the cylinder. When the pressure upon the pivoted rods 79 is relieved, by the rotation of the cams 83, the springs 85 act to reseat the valve 77 and cut off the exhaust of air from the cylinder.

Summing up: generically the operation of the improved motor is as follows: The air is compressed and forced into the reservoir 8, by the operation of the air compressors 35, so that when the valves 12 are opened, the air entering the upper ends of the cylinders 2 will force the pistons 7 downwardly and consequently rotate the crank shaft 3 from which the power may be transmitted to any desired source. The operation of the various valves 12 of the motor or engine is controlled, through the rotation of the shaft 30 by the beveled gears 28 and 29 and the sleeve 17 so that the various pistons will be operated at different times for providing a power stroke always to the crank shaft 3 the cranks of which are disposed at angles at ninety degrees to each other so that no two of the pistons will be off centered at the same time. The quantity of air admitted to the cylinders 2 is controlled by the operation of the frusto-conical member 20 as previously described and the pressure of air within the reservoir 8 is controlled by the pressure valve 61, and the operation of the piston 55 eliminates any danger of the liability of breakage of the reservoir 8 under excessive pressure.

The improved power plant is primarily designed for the propulsion of motor vehicles, and by utilizing the compressed air engine in lieu of an ordinary gasolene or kerosene engine, a smooth even running engine is provided which eliminates the sudden jerks or movements occasioned by the starting and stopping of the gasolene engine; and a gasolene engine or any other suitable type of prime mover as indicated diagrammatically at 100 in Fig. 1 of the drawings may be provided for operating the shaft 15 and the air compressors or pumps 35.

From the foregoing description taken in connection with the accompanying drawings the advantages of construction and of the

method of operation of the improved compressed air power plants will be readily apparent to those skilled in the art to which this invention appertains and, while in the foregoing description, the principle of the operation of this invention has been described together with various features of construction, it is to be understood that certain minor features of construction, combination and arrangement of parts may be altered to suit practical conditions provided such alterations are comprehended within the scope of what is claimed.

What I claim is:

1. In a compressed air power plant, the combination, of a cylinder, a piston reciprocably mounted in the cylinder, a compressed air retaining reservoir supported above said cylinder, a pipe leading from the reservoir to the inlet of the cylinder, a valve positioned within said pipe for controlling the passage of air into said cylinder, a stem connected to said valve, a sleeve supported by said engine and rotatable by the reciprocatory movement of said pistons, and means carried by said sleeve for engagement with said valve stem for operating said valves.

2. In a compressed air power plant, the combination, of a cylinder, a piston reciprocably mounted in the cylinder, a compressed air retaining reservoir supported above said cylinder, a pipe leading from the reservoir to the inlet of the cylinder, a valve positioned within said pipe for controlling the passage of air into said cylinder, a stem connected to said valve, a sleeve carried by said engine and rotatable by the reciprocatory movement of said pistons, means carried by said sleeve for engagement with said valve stem for operating said valves, and means for adjusting the position of said valve stem engaging means for regulating the scope of movement of said valves for regulating the quantity of air admitted to said cylinders.

3. In a compressed air power plant, the combination, of a cylinder, a piston reciprocably mounted in the cylinder, a compressed air retaining reservoir supported above said cylinder, a pipe leading from the reservoir to the inlet of the cylinder, a valve positioned within said pipe for controlling the passage of air into said cylinder, a stem connected to said valve, a sleeve carried by said engine and rotatable by the reciprocatory movement of said pistons, means carried by said sleeve for engagement with said valve stem for operating said valves, means for adjusting the position of said valve stem engaging means for regulating the scope of movement of said valve for regulating the quantity of air admitted to said cylinders, an exhaust port formed in said cylinder, a valve normally closing said exhaust port, a valve stem projecting upwardly from said valve, a pivotally mounted arm carried by said cylinder for engagement with said valve stem for unseating said exhaust valve, and means operable upon reciprocatory movement of said piston for rocking said pivoted arm.

4. In a compressed air power plant, the combination, of a cylinder, a piston reciprocably mounted in the cylinder, a compressed air retaining reservoir supported above said cylinder, a pipe leading from the reservoir to the inlet of the cylinder, a valve positioned within said pipe for controlling the passage of air into said cylinder, a stem connected to said valve, a sleeve carried by said engine and rotatable by the reciprocatory movement of said pistons, means carried by said sleeve for engagement with said valve stem for operating said valve, means for adjusting the position of said valve stem engaging means for regulating the scope of movement of said valve for regulating the quantity of air admitted to said cylinders, an exhaust port formed in said cylinder, a valve normally closing said exhaust port, a valve stem projecting upwardly from said valve, a pivotally mounted arm carried by said cylinder for engagement with said valve stem for unseating said exhaust valve, means operable upon reciprocatory movement of said piston for rocking said pivoted arm, air compressors for charging said air reservoir, and means operable under the excessive air pressure when in said reservoir for automatically arresting operation of said air compressors.

5. In a compressed air power plant, the combination, of a cylinder, a piston reciprocably mounted in the cylinder, a compressed air retaining reservoir supported above said cylinder, a pipe leading from the reservoir to the inlet of the cylinder, a valve positioned within said pipe for controlling the passage of air into said cylinder, a stem connected to said valve, a sleeve carried by the engine and rotatable by the reciprocatory movement of said piston, means carried by said sleeve for engagement with said valve stem for operating said valve, means for adjusting the position of said valve stem engaging means for regulating the opening of said valve for regulating the quantity of air admitted to said cylinder, an exhaust port formed in said cylinder, a valve normally closing said exhaust port, a valve stem projecting upwardly from said valve, a pivotally mounted arm carried by said cylinder for engagement with said valve stem for unseating said exhaust valve, means operable upon reciprocatory movement of said piston for rocking said pivoted arm, air compressors for charging said air reservoir, means operable under the excessive air pressure in said reservoir for automatically arresting operation of said air compressors,

and means automatically operated upon decreasing of excessive air pressure within said reservoir for restarting said air compressor.

6. In a compressed air power plant, the combination of a compressed air engine, an air reservoir supported by said engine, air supply pipes communicating with said reservoir and said engine, means operable by the operation of said engine for controlling the inlet of air into the engine through said pipe, air compressors communicating with said reservoir, and means for operating said compressors.

7. In a compressed air power plant, the combination of a compressed air engine, an air reservoir supported by said engine, air supply pipes communicating with said reservoir and said engine, means operable by the operation of said engine for controlling the inlet of air into the engine through said pipes, air compressors communicating with said reservoir, means for operating the compressors, and means operated by an excessive air pressure in said reservoir to arrest the operation of said compressors.

8. In a compressed air power plant, the combination of a compressed air engine, an air reservoir supported by said engine, air supply pipes communicating with said reservoir and said engine, means operable by the operation of said engine for controlling the inlet of air into the engine through said pipes, air compressors communicating with said reservoir, means for operating said compressors, means operated by an excessive pressure in said reservoir to arrest the operation of said compressors, and means automatically operated upon the decreasing of an excessive air pressure within said reservoir for restarting said compressors.

9. In a compressed air power plant, the combination of a compressed air engine, an air reservoir supported by said engine, air supply pipes communicating with said reservoir and said engine, means operable by the operation of said engine for controlling the inlet of air into the engine through said pipes, air compressors communicating with said reservoir, means for operating said air compressors, means operated by an excessive air pressure in said reservoir to arrest the operation of said compressors, said last named means including a clutch, a cylinder having communication with said air reservoir, a pressure valve for controlling the entrance of air into said last named cylinder, a piston mounted within said cylinder and operable upon entrance of air into the cylinder to operate said clutch for arresting operation of said compressors.

10. In a compressed air power plant, the combination of a compressed air engine, an air reservoir supported by said engine, air supply pipes communicating with said reservoir and said engine, means for controlling the inlet of air into the engine through said pipes, air compressors communicating with said reservoir, means for operating said compressors, means operated by an excessive air pressure in the reservoir to arrest the operation of said compressors, said last named means including, a clutch, a cylinder having communication with said air reservoir, a pressure valve for controlling the entrance of air into said cylinder, a piston mounted within said cylinder and operable upon entrance of air into said cylinder to operate said clutch for arresting operation of said compressors, means for returning said piston to its normal position upon the arresting of air entrance into said cylinder for operating said clutch to permit of restarting the said compressors.

11. In a compressed air power plant, the combination of a compressed air engine, an air reservoir supported by said engine, air supply pipes communicating with said reservoir and said engine, means for controlling the inlet of air into the engine through said pipes, air compressors communicating with said reservoir, means for operating said compressors, means operated by an excessive air pressure in the reservoir to arrest the operation of said compressors, said last named means including a clutch, a cylinder having communication with said air reservoir, a pressure valve for controlling the entrance of air into said cylinder, a piston mounted within said cylinder and operable upon entrance of air into said cylinder to operate said clutch for arresting operation of said compressors, means for returning said piston to its normal position upon the arresting of air entrance into said cylinder for operating said clutch to permit of restarting the said compressors, and means releasable by the entrance of air into said cylinder for preventing accidental movement of said piston.

In testimony whereof I affix my signature in presence of two witnesses.

SEWARD S. VERNON.

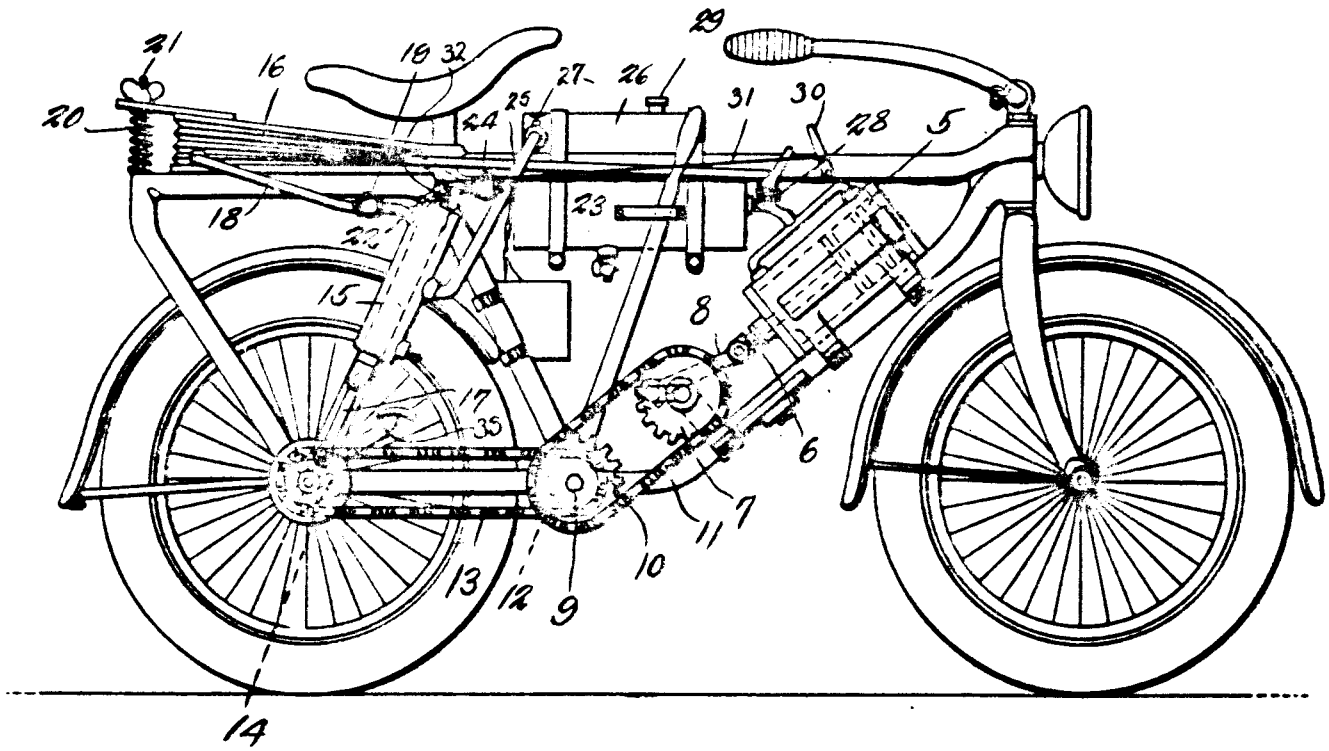
Witnesses:
MARCELLA M. SHEEHAN,
ROE E. VERNON.

Nov. 4, 1930. R E. FORMAN 1,780,705

AIR PROPELLED MOTOR CYCLE

Filed June 1. 1929 2 Sheets-Sheet 1

Fig. 1.



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AIR PROPELLED MOTOR CYCLE

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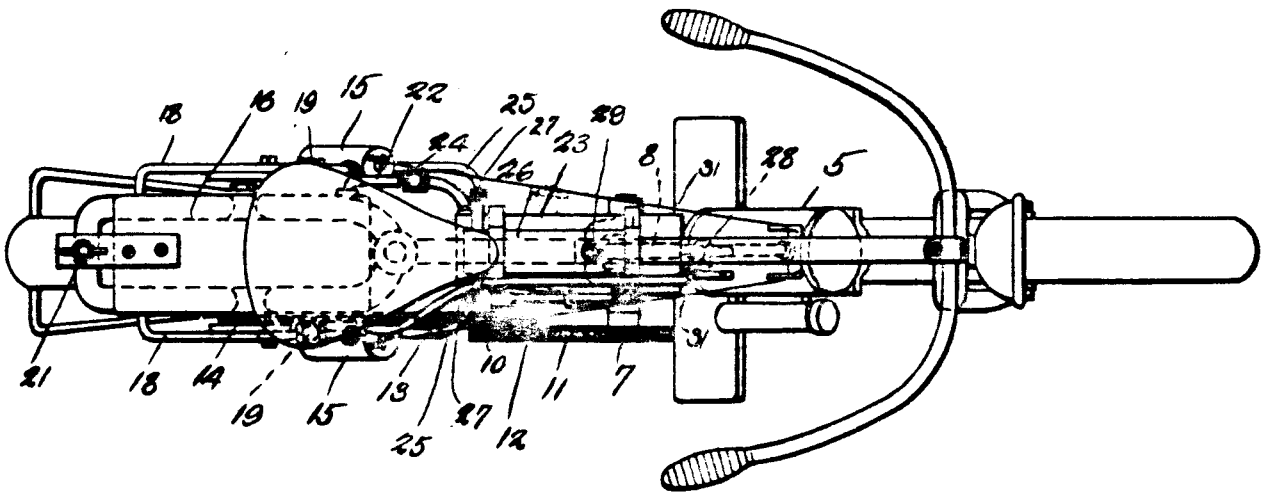
Fig. 2.



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Patented Nov. 4, 1930 1,780,705

UNITED STATES PATENT OFFICE

ROBERT E. FORMAN, OF CINCINNATI, OHIO

AIR-PROPELLED MOTOR CYCLE

Application filed June 1, 1928. Serial No. 282,149.

This invention relates to a motor-cycle, the primary object of the invention being to provide a motor cycle operated by an air motor receiving its power from a compressed air tank carried by the motor-cycle into which air is compressed by the action of the rear wheels of the motor-cycle, after the motor-cycle has been set in motion.

Another object of the invention is to provide a motor of this type including means whereby air may be forced into a storage tank so that the initial power may be supplied to the motor.

A still further object of the invention is to provide means for compressing air in a storage tank and admitting water to the air in its passage to the storage tank causing an expansion to create power.

With the foregoing and other objects in view which will appear as the description proceeds, the invention resides in the combination and arrangement of parts and in the details of construction hereinafter described and claimed, it being understood that changes in the precise embodiment of the invention herein disclosed, may be made within the scope of what is claimed, without departing from the spirit of the invention.

Referring to the drawings:

Figure 1 is an elevational view of a motor-cycle equipped with an air motor constructed in accordance with the invention.

Figure 2 is a plan view thereof.

Referring to the drawings in detail the invention is shown as mounted on the frame of a motor-cycle, and includes a cylinder 5 in which a piston operates, the piston embodying a rod 6 that imparts movement to the sprocket 7 through the medium of the link 8. Movement of the sprocket 7 is transmitted to the shaft 9 through the sprocket 10 mounted on the shaft 9, and the chain 11 which operates over the sprockets.

A small sprocket 12 is mounted on the shaft 9 and imparts movement to the rear wheel through the medium of the chain 13 and sprocket 14, the sprocket 14 being mounted on the rear axle of the motor-cycle. Mounted on the rear fork of the motor-cycle frame at opposite sides thereof are compressors 15 that also embody pistons which operate to compress air in the tank 16. The pistons of the compressors are operated by means of the links 17 that connect eccentrically with disks mounted on the rear axle.

The upper ends of the compressors 15 communicate with the expansion tank 16, through the pipes 18, there being provided check valves 19 in the pipes to prevent return of the air after it has been forced into the pipe 18. This tank 16 is in the form of a bellows so that the tank will be permitted to expand as air is forced thereinto, thereby relieving excess pressure in the tank. An adjusting mechanism including coiled spring 20 and bolt 21 provides means to limit the expansion of the tank 16. It will also be seen that owing to the construction of the expansion tank 16, the tank may be operated in the same manner as a bellows to force air into the storage tank, to be hereinafter more fully described, so that the initial power may be directed to the engine cylinder.

At the forward end of the expansion tank 16 is a pipe 22 that extends into the storage tank 23, there being provided a one-way valve 24 to permit air to pass from the expansion tank to the tank 23, but prevent reverse movement of the air. Pipes indicated at 25 establish communication between the compressors 15 and the water tank 26, so that water may be fed in drops to the compressors at points intermediate the ends of the compressors, a valve 27 being provided for regulating the passage of water through the pipes.

As water is admitted to the compressors, the compressors being hot, due to friction, the water is converted into steam and an expansion is set up resulting in the generation of power. A control valve indicated at 28 controls the passage of air to the engine so that the operator may control the speed of the engine by admitting greater or less quantities of the air to the engine. Mounted on the water tank is a gauge 29 so that the pressure may be determined at all times.

Pivotally supported adjacent to the handle bars, or at a place in easy access to the operator, is a lever 30 to which the rod 31 is con-

nected that extends rearwardly and connects with the valve 32 designed to control the passage of air from the compressors, the valve being of the relief type.

A clutch of suitable construction is mounted at the rear axle and is designed to clutch the rear wheel to the axle, there being provided a clutch pedal 33 so that the operator may operate the clutch to control the movements of the motor-cycle.

In the operation of the device the expansion tank 16 is operated by hand to store up air in the tank 23, whereupon the valve 28 is operated allowing air to pass to the engine cylinder, which in turn imparts rotary movement to the sprockets and rear wheel through the chains.

As the motor-cycle descends a hill, it is obvious that the rear wheel will act to operate the compressors to force air into the expansion tank, which in turn supplies moistened air to the storage tank.

I claim:

A motor-cycle propelling means including a motor embodying a cylinder, a piston operating in the cylinder, means for transmitting movement of the piston to the drive wheels of the motor-cycle, a compressed air tank, a pipe establishing communication between the compressed air tank and cylinder, a manually operated expansion tank for providing the initial supply of compressed air to the compressed air tank, a pipe for establishing communication between the compressed air tank and expansion tank, a compressor operated by the momentum of the motor-cycle, a pipe establishing communication between the compressor and the expansion tank, a water tank mounted above the compressor, a pipe establishing communication between the water tank and the compressor for delivering drops of water to the compressor.

In testimony that I claim the foregoing as my own, I have hereto affixed my signature.

ROBERT E. FORMAN.